



# URS

## Washington TRU Solutions LLC

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### **The Waste Isolation Pilot Plant** Update on Operational Performance

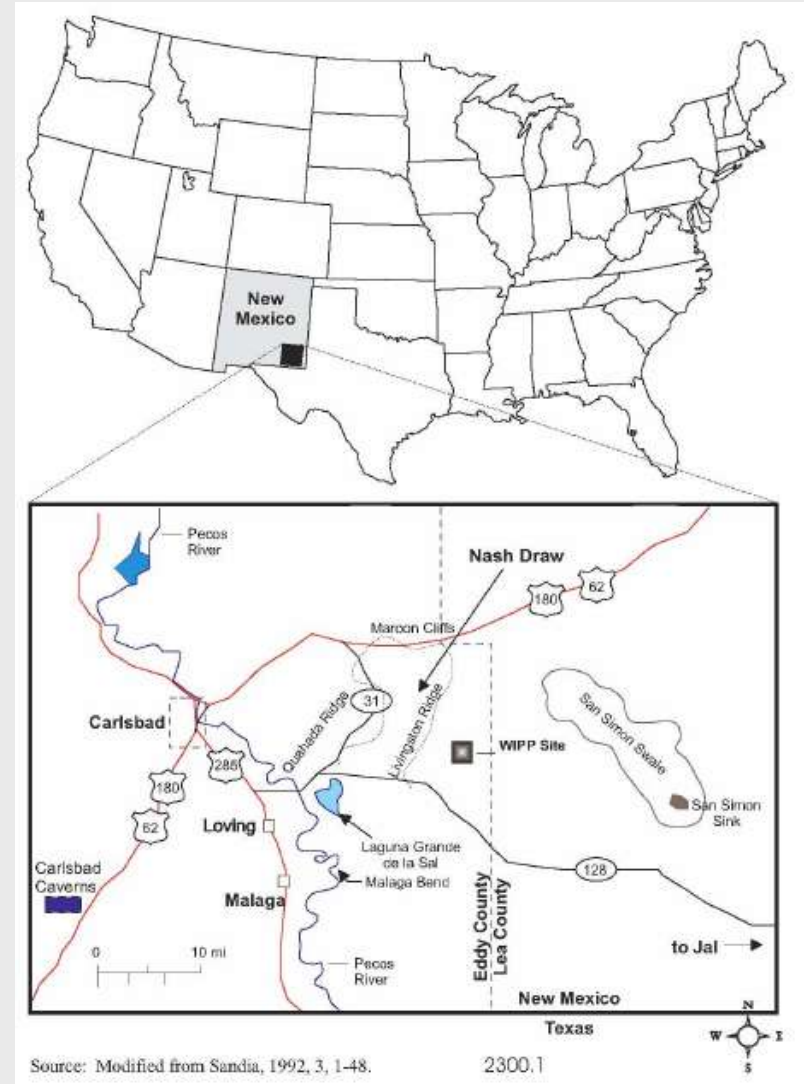
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Principal Engineer  
WIPP Site, MS 486-05, PO Box 2078  
Carlsbad, NM 88221

# General Regional Details



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- Situated approximately midway between Hobbs and Carlsbad, N.M.
- Approximately 42 miles directly west of the National Enrichment Facility (by URENCO USA, LLC) and Waste Control Specialists
- Isotopes International deconversion facility coming between Hobbs and WIPP



# Waste Isolation Pilot Plant (WIPP)



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- The world's first licensed geological repository for transuranic (TRU) waste
- Located in southeast New Mexico approximately 26 miles east of Carlsbad
- The site is composed of 10,240 acres with the underground facility footprint of about 550 acres
- WIPP employs around 650 individuals



# WIPP Waste



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- Basically just trash from weapons complex work including discarded PPE or cleanup activities
- Most of the waste is contact-handled TRU (CH-TRU) - less than 200 mrem/hr on contact
- Comes in multiple containers
- Can be remote-handled TRU (RH-TRU) which is 200 mrem/hr or greater on contact
- Requires extensive characterization to meet our waste acceptance criteria



# Opening WIPP and Beyond...



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- March 26, 1999, first waste shipment and emplacement in the WIPP underground
- Because of the intensely dedicated commitment to safety and environmental protection, the WIPP site has continually enjoyed substantial grass roots support from its surrounding communities.
  - Multiple instances of 2 million safe worker hours (7 single)
  - First DOE site to earn “Star” status in DOE Voluntary Protection Program based on safety excellence
  - WTS has maintained WIPP VPP Star status for 16 years
  - WIPP received prestigious Transportation Safety Award from U.S. Transport Council
  - A large number of emergency response team awards (medical and mine rescue)
  - Multiple nominations for the National Medal of Technology and Innovation
  - Obtained the top mine safety award 23 out of 25 years for NM
    - Rules were changed on those years when we did not receive the award

# WIPP Regulators and Oversight



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- Department of Energy (10CFR820, 10CFR830, 10CFR835, 10CFR851, standards, orders etc.)
- Environmental Protection Agency (40CFR191&194, NESHAPS)
- State of New Mexico (RCRA, hazardous waste facility permit)
- Nuclear Regulatory Commission (transportation packages)
- Department of Transportation
- Mine Safety and Health Administration (MSHA)
- DNFSB
- OSHA, DOL, etc.

# WIPP is the crown jewel of operational excellence



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- The waste arrived in over 10,000 shipments traveling over more than 12 million loaded miles!
  - Equivalent to 24 trips to the moon and back without a single detectable release of radioactivity
- Total waste emplaced is over  $2.8E6 \text{ m}^3$
- Capacity limited to  $6.2E6 \text{ ft}^3$
- Activity limit  $5.1E6 \text{ Ci}$



# Disciplined operations = operational excellence (every time)



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- If it is not written down, it did not occur.
- Anything relied on for safety WILL be tested.
  - At appropriate frequencies using appropriate methodologies
- Managers are held directly accountable for the results of activities within their areas of responsibility.
- Employees are directly responsible for safe performance on the job.
- All individuals WILL be appropriately trained and equipped for their work activities.



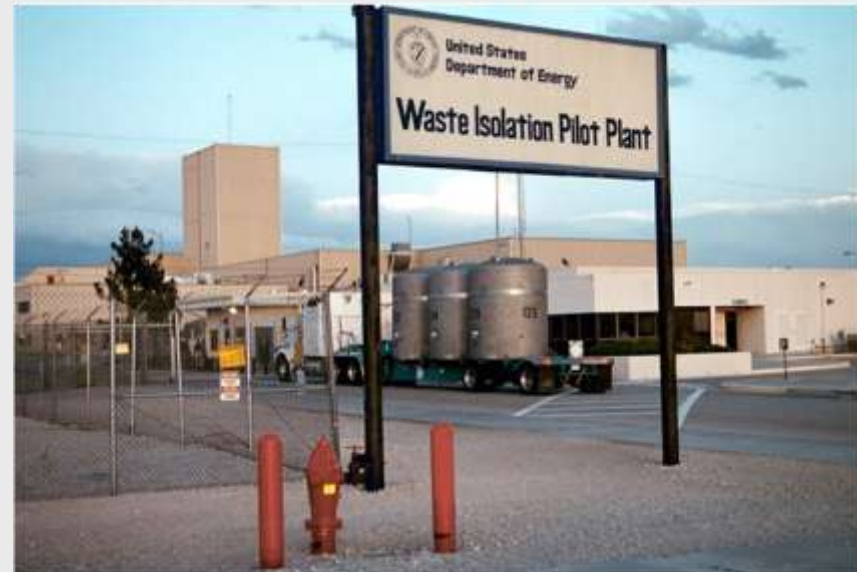
- Our main product is *not* “cans in the hole”.
- Our main products are 1) Safety, 2) Regulatory Compliance and 3) Quality
  - *After* these, our fervent goal *then* becomes cost effective emplacement of TRU waste in the underground repository
    - Conduct of operations is critical to the facility mission.
    - Dispose of transuranic waste in an environmentally sound and safe manner while exceeding customer expectations for reducing costs and accelerating schedules.
    - The employees and management are committed to achieving this mission and setting a benchmark standard of technical excellence and fiscal responsibility for the world's first transuranic waste repository.

# WIPP Strives to Achieve Good Stewardship of Taxpayer Money



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- WIPP has cost taxpayers around 5 billion US\$ to date
  - This does not include generator sites own funding for TRU waste
- Yucca Mountain has cost around 10 billion US\$.
- Clearly very different scope and missions for geological repositories.
  - Is this a reasonable comparison? Maybe not, there are a number of factors.



# Homeland Security



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- 21 separate generator sites have now had all their TRU waste permanently removed
  - Rocky Flats was able to become free released to green field status
- Over 2 million Curies of transuranic waste has now been permanently removed from the biosphere!
  - Order of  $10^{12}$  ALI (that is a great benefit for the protection of human health and environment)



# A metric for cost effectiveness? (could be misleading)



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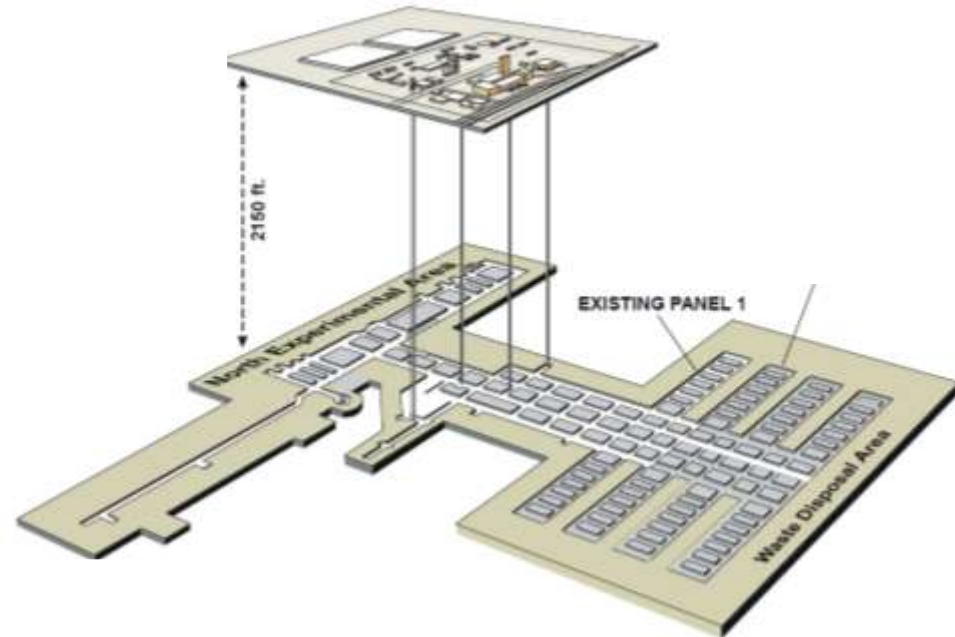
- Start with an ad-hoc estimation for the LD50 for internal uptake of 10,000 ALI
- From this relationship,  $1 \text{ LD50} = 1\text{E}4 \text{ ALI}$ , from which we get  $1\text{E}12 \text{ ALI} \times 1\text{LD50}/1\text{E}4 \text{ ALI} = 1\text{E}8 \text{ LD50}$
- The WIPP would then have permanently removed from the biosphere  $1\text{E}8 \text{ LD50}$  of activity.
- Using then the number  $1\text{E}10 \text{ US\$}$  as a total cost estimate for WIPP, this means that taxpayers have spent around  $1\text{E}10 \text{ US\$}/1\text{E}8 \text{ LD50} = 100 \text{ US\$ per LD50}$ 
  - Permanently removed from the biosphere via the WIPP
- Using these units is misleading insofar that they suggest the activity can be distributed for intake (or is already completely inside the food you are eating).

# WIPP Basics



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- The repository is about half a mile below the surface in a mile thick salt dome with a larger cross sectional area than the state of West Virginia
  - Elegance in design
- Many technical journal papers have been published founded on science based operations
- Conduct of operations is treated like gospel
- This is not rocket science, it is nuclear science!



# Creep in an underground salt mine



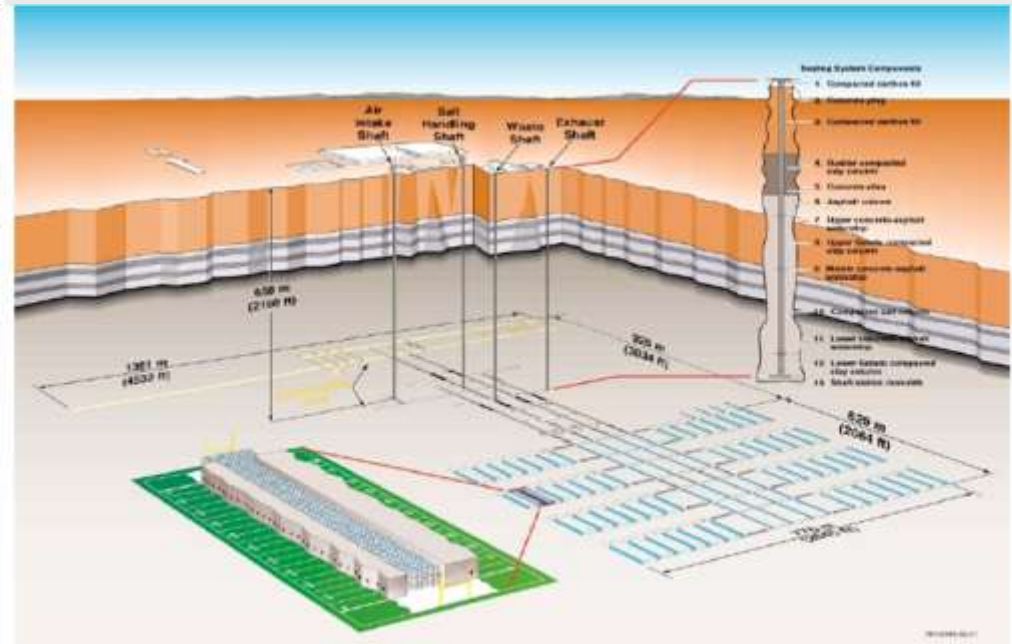
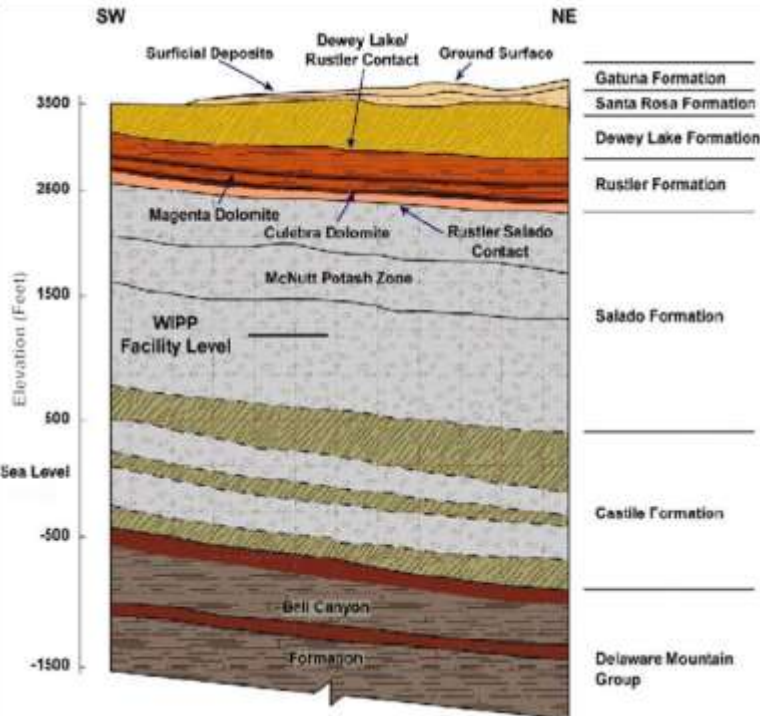
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- Primary, secondary and tertiary phases.
- Primary phase is governed by stress-strain.
- Secondary phase does not begin until either equilibrium or a steady state is reached by the stress induced strain for the opening(s) in the rock.
- The tertiary phase is that portion occurring when full degradation of structural integrity is not prevented thus allowing this process to begin.
  - The tertiary phase can in theory be prevented indefinitely with adequate engineered systems and component installation.

# WIPP Paradigm



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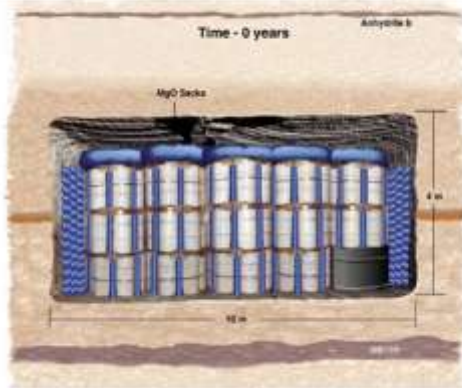
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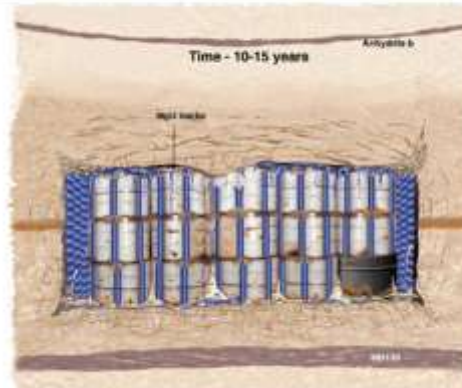
WIPP Room Evolution at Time=0 years

WIPP Room Evolution at Time=12 years

WIPP Room Evolution at 1000 years



9



10



11



# Salt Disposal Investigations (SDI)



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- The studies are designed to test the geologic response of salt to elevated temperatures
- Planned field tests involve heated alcoves built into an underground passage. Electric heaters placed in the alcoves will be used to simulate thermally hot waste packages.



- The alcoves will be heated to temperatures in excess of 160 C in the undisturbed salt. Scientists will measure changes in the salt beds when the salt heats up and cools down, similar to the way a radioactive waste canister would reach a maximum temperature and then cool as the waste decays.
- They will track the movement of brine (trapped in salt crystals) and the salt's ability to heal fractures



# Carlsbad Public Meeting



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U.S. Department of Energy  
Carlsbad Field Office  
Waste Isolation Pilot Plant  
P.O. Box 3090  
Carlsbad, New Mexico 88221

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(575) 234-7270

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## Greater-Than-Class C Low-Level Radioactive Waste Public Hearings Set

**CARLSBAD, N.M., April 21, 2011** – The U.S. Department of Energy (DOE) is holding public hearings on a draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste (LLRW) and GTCC-Like Waste (DOE/EIS-0375D, Draft EIS) as required under the National Environmental Policy Act. Public hearings in New Mexico will take place at the following locations and times.

- April 26, 2011 – Carlsbad, N.M. at the Pecos River Village Conference Center, Carousel House, 711 Muscatel Avenue, 5:30-9:30 p.m.
- April 27, 2011 – Albuquerque, N.M. at the Marriott Pyramid North, 5151 San Francisco, NE., 5:30-9:30 p.m.
- April 28, 2011 – Santa Fe, N.M. at the Cities of Gold Hotel Conference Center, 10-B Cities of Gold Road, 5:30-9:30 p.m.

The United States Department of Energy (DOE), Office of Environmental Management (EM), is preparing an Environmental Impact Statement (EIS) for disposal of Greater-Than-Class C Low-Level Radioactive Waste (GTCC LLRW). The EIS evaluates potential alternatives involving various disposal methods for application at six federally owned sites and generic commercial sites. This web site is the online center for public information and involvement in the EIS process.



### Announcements

#### **DOE Issues Draft Environmental Impact Statement (EIS) for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste (LLRW) and GTCC-Like Waste (Draft EIS, DOE/EIS-0375D)**

The [Draft GTCC EIS](#) is now available for public review and comment. Public hearings will be held at these locations this spring:

- North Augusta, South Carolina – 4/19/2011
- Carlsbad, New Mexico – 4/26/2011
- Albuquerque, New Mexico – 4/27/2011
- Santa Fe, New Mexico – 4/28/2011
- Las Vegas, Nevada – 5/09/2011
- Idaho Falls, Idaho – 5/11/2011
- Pasco, Washington – 5/17/2011
- Portland, Oregon – 5/19/2011
- Washington, DC – 5/25/2011

See [Getting Involved](#) for specific times and locations of the public hearings and how to submit public comments on the Draft EIS.

#### **Brief Overview of Draft EIS**

- The Draft EIS evaluates the potential environmental impacts associated with constructing and operating a new facility or facilities, or using an existing facility, for the disposal of GTCC LLRW and GTCC-like waste.
- Disposal methods evaluated include geologic repository, intermediate depth borehole, enhanced near surface trench, and above grade vault. Disposal locations evaluated include the Hanford Site in Washington; the Idaho National Laboratory in Idaho; the Los Alamos National Laboratory, the Waste Isolation Pilot Plant (WIPP), and the WIPP vicinity in New Mexico; the Nevada National Security Site (formerly the Nevada Test Site) in Nevada; and the Savannah River Site in South Carolina. The Draft EIS also evaluates generic commercial disposal sites and the No Action Alternative.
- *DOE does not have, and therefore has not identified, a preferred alternative in the Draft EIS, but will do so in the Final EIS based on further consideration and public comment. The preferred alternative could be a combination of two or more alternatives, based on the characteristics of the waste, its availability for disposal, and other key factors.*

# Remote Handled TRU Waste



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- Requires continuous shielding
- Maximum 1000 rem/hr contact
- 95% of all RH TRU less than 100 rem/hr contact
- Minimum dose rate of 200 mrem/hr contact
- Maximum 23 Ci/liter activity density
- Relatively large content of Sr/Y-90 and Cs-137
- Lower worker doses than in CH-TRU



# Emergency Response Training



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- Modular Emergency Radiological Response Transportation Training (MERRTT)
  - real-world training for real-world issues
  - modules range from an overview of radioactive material and response issues to the more complex topics of radiological instrumentation
- Command and control
- Incident Command System
- Train-the-Trainer
  - Includes tour of the WIPP site for state or local trainers
- Medical management for hospital personnel

# Satellite tracking of shipments

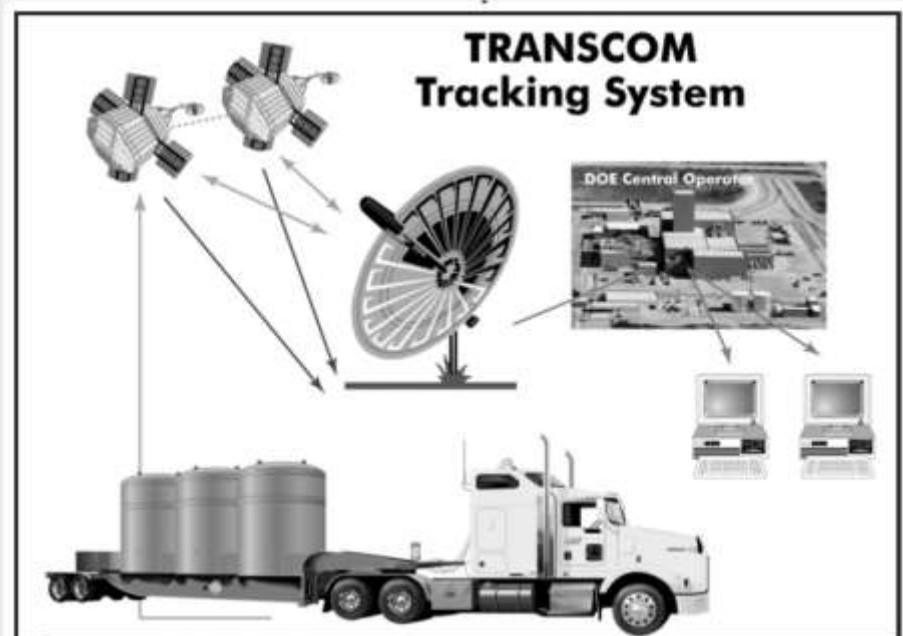


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## Transportation Tracking and Communication System (TRANSCOM)

- Federal, state and local officials can monitor the shipments
- TRANSCOM personnel monitor WIPP shipments around the clock from a secure center, using satellite communication and computer networks to pinpoint the location of shipments en route

Tracks DOE unclassified radioactive materials shipments as a public safeguard



# TRUPACT-III and the standard large box



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- Rather than break down entire glove box systems into 55-gallon drums, package the entire glove box
- Breaking down large items such as lathes, presses and glove boxes generates substantial additional waste and operator risk
- Save time and money



# Light Weight Facility Cask



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- Designed to handle RH canister up to 100 rem/hr (only 5% of RH-TRU will be greater than 100 rem/hr)
- Having an additional facility cask will permit surface and UG operations simultaneously
- Factory acceptance testing underway



# Waste to be Consolidated at Idaho Site Before Shipment to WIPP



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- The U.S. DOE is consolidating defense TRU wastes at its Idaho Site for testing and treatment prior to shipment to WIPP
- Takes advantage of the facility's Advanced Mixed Waste Treatment Project (AMWTP) and compaction operations



# Central characterization project



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- Batch Data Package
  - Project Office Data Package - Tracking System
- Non-Conformance reports
- Corrective Action Reports
- Acceptable Knowledge
- Training, Lessons Learned
- Documents, Procedures
- Maintenance and Testing Equipment Information
- Performance Indicators





# How will future generations be warned?

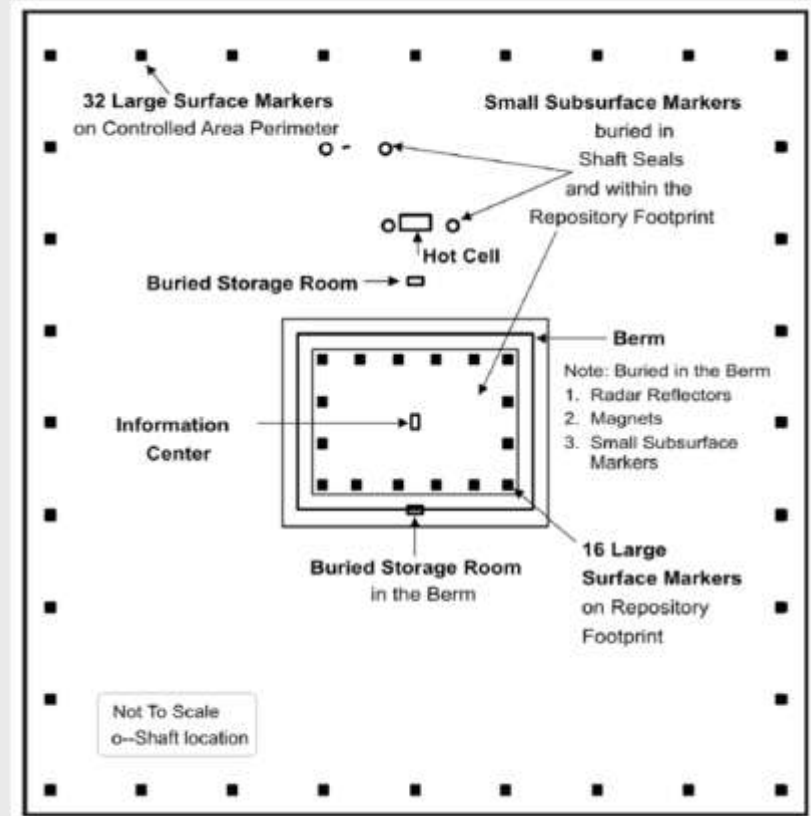


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## Passive Institutional Controls

- A large berm
- Perimeter monuments
- An information center
- Two information storage rooms
- Buried warning markers
- Archives stored in various locations around the world

## Conceptual design of permanent marker system

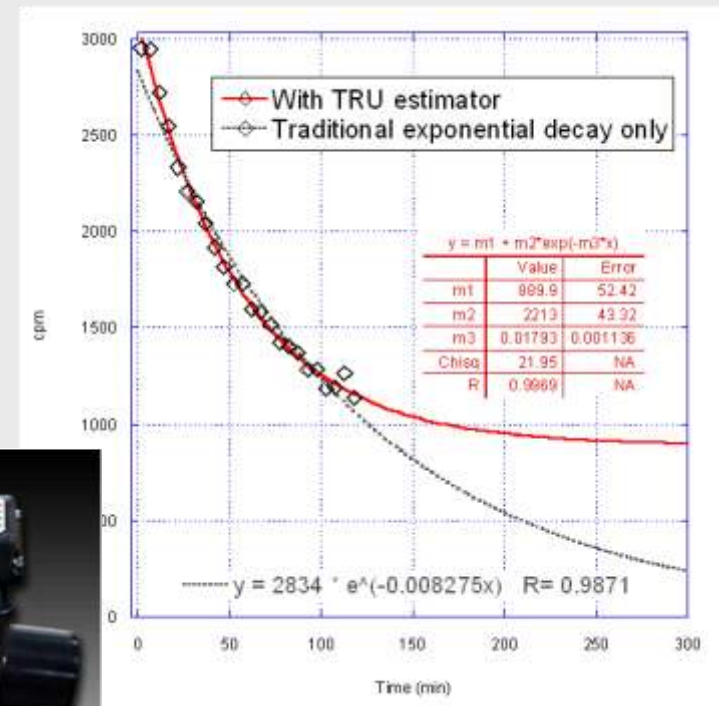
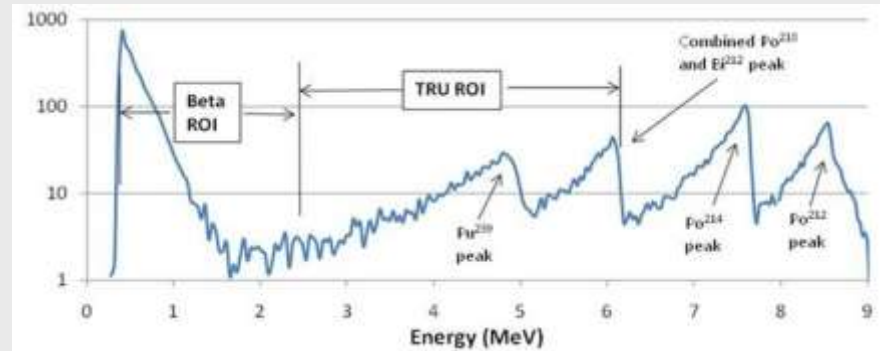


# Radiological and Nuclear Sciences

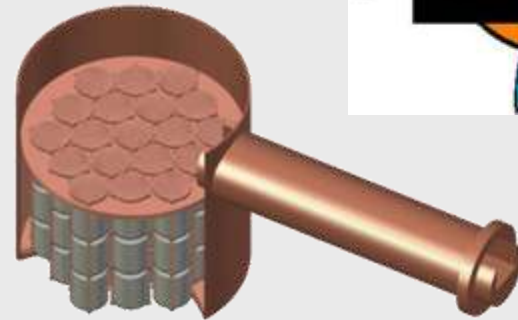


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- Alpha spectrometry for radon progeny mitigation in operations
  - Both spectral algorithms and decay curve fitting
- Gamma spectrometry for rapid detection and discrimination of high  $^{241}\text{Am}$  contamination levels from radon progeny
  - 2000 dpm/100cm<sup>2</sup>



- Enriched Xenon Observatory
  - Double beta decay of  $^{136}\text{Xe}$  (neutrinoless giving evidence that a neutrino is its own antiparticle)
- Majorana
  - 120 kg of HPGe (with  $^{76}\text{Ge}$ )
- Dark matter search for WIMPs (weakly interacting massive particles)
  - Detector design is a dark matter time projection chamber of  $\text{CF}_4$



# Conclusion



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- WIPP has shown fervent commitment to safety, quality, regulatory compliance, disciplined operations and excellence in all aspects of TRU waste disposal
- WIPP has enjoyed over 12 years of safe regulatory compliant operations disposing of radioactive waste in a fully licensed deep geological repository
- WIPP has overcome substantial technical, political and operational difficulties to obtain our performance metrics
- WIPP is committed to science based solutions to operational difficulties
- The WIPP model has proven that radioactive waste can be transported and disposed of safely in geological repositories protecting the people and environment of the United States